

BENCHMARKS

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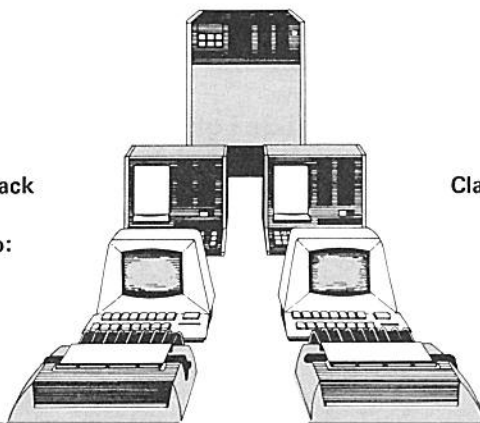
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Services Available To Users Of The NTSU Computing Facilities

All people mentioned below may be contacted by calling
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Information, Project Numbers, and IDs- Carolyn Goodman in the
Computing Center reception Area, ISB 119.

Newsletter Questions/Contributions/etc. - Claudia Putnam.

Statistical/Research Support (provided for graduate students
and faculty members) - Bob Brookshire, George Morrow,
Claudia Putnam, Steve Glick, and Victor Loos.

Non-Research Student Programming Problems - student consultants
from the Computer Science Department are located in GAB
550L. Student consulting provided by the College of
Business is available at the BA Computing Access Facility.

JCL and Debugging Problems - George Morrow.

Pre-Research Counseling, Including Survey Instrument Design -
Bob Brookshire, George Morrow, Claudia Putnam, Steve
Glick, and Victor Loos.

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Stickney. HP 2000 information and/or problems - Jeff
Brooks.

Administrative Applications - Coy Hoggard.

Computer Hardware/Software/Billing Problems - Sandy Franklin

JOB Submission and Retrieval - RJE Operators.

December Computing Hours

Computing facilities will be open during the following times
in December (except for Semester Break):

Computing Center RJE: 8 AM - Midnight, Monday-Saturday;
Noon-Midnight, Sunday.

ISB 110 Terminal Area: TEMPORARILY CLOSED UNTIL FURTHER NOTICE

College of Business RJE: 8:15 AM - Midnight, Monday-Saturday;
12:15 PM - Midnight, Sunday.

5th Floor GAB: December 1-10: 8 AM-11 PM, Monday-
Friday; Noon-8 PM, Sunday. December 11-
17: 8 AM-5 PM, Monday-Friday; Noon-8
PM Sunday.

ALTERED HOURS OF OPERATION

The following hours will be in effect over the Semester Break (December 17 - January 15):

Computing Center RJE : CLOSE: Midnight, Saturday, December 17.
OPEN: 8 AM - Midnight: December 19-23.
8 AM - 5 PM: December 26-30.
RESUME REGULAR SCHEDULE: January 2.

ISB Terminal Area (110) : TEMPORARILY CLOSED UNTIL FURTHER NOTICE

College of Business RJE : CLOSED: December 17 - January 15.

5th Floor GAB : CLOSED: December 16, 5 PM - January 15.

MVS COMES TO NTSU, BRINGING SOME CHANGES WITH IT

The next phase of the upgrading of available computing resources at the NTSU Computing Center will be conversion from MVT/DSX (a version of OS/MVT) to MVS/SP 1.3 as the production batch and database operating system on the NAS cpu's. The change is scheduled to take place January 2, 1984. At that time, all administrative processing will be migrated to the NAS 6650 and MVT/DSX will be replaced with MVS on the 8040. Other systems (MUSIC, CMS) will be unaffected.

In an effort to make access to the various systems more consistent, a uniform system for userids is also being implemented. For the batch user, this will require some changes on the JOB card as described below. In essence, the old Project Number will no longer be coded; in its place will be a USERID, which will be identical to the user's MUSIC and/or VAX/VMS ID. In addition, a password will be required on MVS JOB cards to allow access to the system.

Users may start converting JOB cards beginning Monday, December 19, 1983. From that date until January 2, either format will be allowed on the MVT system. As of January 2, only the MVS format will be allowed; coding the old format will result in an invalid job card message.

For example:

MVT JOB card -
//MYJOB JOB (1234-5678,:1,1),'MY NAME',CLASS=A

MVS JOB card -
//MYJOB JOB (XX99,:1,1),'MY NAME',CLASS=A,PASSWORD=ABCDEF

(Note: The password will be blanked out on output listings.)

If you choose to convert before January 2, you must observe a few additional rules:

1. PASSWORD= must be the last parameter on the JOB card.

2. If your job card is continued, there must be at least one parameter preceding PASSWORD= on the last continuation card (e.g., CLASS=A,PASSWORD=ABCD).
3. You will not be able to change your password (as described below) until MVS is up. You must change your password as soon as possible after January 2.

As of January 2, the following rules will apply:

1. New format job cards will be required. Initially, passwords will be the same as IDs. By the end of January, any job card with password equal to ID will be cancelled by the system, so you will need to change your password as soon as possible (see the procedure below.)
2. To change your password, run the following job on MVS:

```
//XX99CHPW JOB (XX99,:5,1),'MY NAME',CLASS=A,PASSWORD=ABCD
// EXEC  CHANGE PW
//SYSIN DD *
PASSWORD PASSWORD(ABCD WXYZ)
/*
```

- Notes: 1. Use your own valid JOB card, including ID and PASSWORD.
 2. On the PASSWORD card, code the old password first, then the new password.

Access to the batch systems will be controlled by IBM's Resource Access Control Facility (RACF), based on userid and password. Later in the semester RACF will be extended to control dataset access as well.

The naming conventions for MVS disk datasets will be slightly different. All user-owned datasets should have names of the form USER.userid.filename, where 'userid' is the userid as described above, and 'filename' is one or more user-selected qualifiers. RACF control will require that datasets fit this scheme, so you should begin renaming existing disk files as soon as possible. For example,

current name: USER1.D1234.P5678.MYFILE.DATA

new name: USER.XX99.MYFILE.DATA .

IBM utilities are available to accomplish the renaming of disk files. One such utility is IEHPROGM:

```
//jobname JOB (xxxx-yyyy,:05,1),'your name'
// EXEC IEHPROGM
  RENAME DSNAME=old.data.set.name,VOL=SYSDA=,volumename, *
          NEWNAME= USER.XXnn.newname
          ↑                               ↑
        (col. 16)                       (col. 72)
```

For assistance, contact Academic Computing at 565-2324.

We hope that the migration will be transparent to the user (except for the changes above). Other minor changes will be slightly rearranged JCL and message log listings and a few new messages.

MVS/SP 1.3 is IBM's most current operating system. It offers many advantages over MVT, some of which will require changes on the part of the user if full advantage is to be taken of them; however, it is generally compatible with MVT, so changes are not required. The main advantages to most users will be improved memory management and device allocation, which will result in better batch throughput.

Early in the semester VSAM (Virtual Storage Access Method) files will be available for general use. Watch BENCHMARKS for further information.

Computing Center personnel have been testing MVS since September on the 8040 and the 6650. It has been very stable and compatible to this point, and we hope it will remain so.

CALL 3270, THE SENSIBLE ALTERNATIVE TO CALL 8040 OR CALL 8300

Last month's BENCHMARKS announced that 3270 protocol converters would soon be available for use over the Local Area Network to access operating systems such as MUSIC and CMS running on the AS/8040 computer. These protocol converters allow ASCII terminals (VT100s, MIMES, TELEVIDEOS, etc.) to emulate IBM 3270 type terminals, thus allowing FULL SCREEN EDITING capabilities. The protocol converters are now available and can be accessed from the network by typing: CALL 3270. Naturally, you need to become familiar with the Full Screen Editor on whatever system you are working with in order to use this facility to its fullest capacity. Consult BENCHMARKS, Volume 4 Number 5 for more information on the protocol converters and their use and/or come by the reception area of the Computing Center and pick up a copy of the Quick Reference Card on "Using the 3270 Protocol Converter at NTSU."

FEAR NOT: YOUR QUESTIONS ANSWERED HERE

Recently, the Computing Center has received many questions about the new computing facilities, and access to these facilities. As most of these questions are of a general nature, we decided to share them and our responses with the readers of BENCHMARKS.

- Q QUESTION: What happened to the terminal room in the Science and Technology Library, which was open earlier this semester?
- Q ANSWER: When the terminal room in the Science and Technology Library was opened earlier in the semester, we had 152 terminals available. Sixty-four were located in the College of Business terminal room, 64 on the fifth floor of the General Academic Building, and 24 in Room 110 of the Library. Unfortunately, we had at that time only 86 ports available on the NAS 8040 computer. Thus, we had many more terminals than connections to the IBM-compatible machine. This situation would have been bearable had more of the terminals been used to access the VAX or HP-2000 computers, but the demand for 8040 access remained high. By temporarily closing the terminal room in the Library, we were able to make more ports on the 8040 available. We are in the process of increasing the number of ports on the 8040. Currently, there are 114 ports available on the 8040, 66 of which are reached through the "CALL

8040" command on the local area network, 16 through the "CALL 8300" command, and 32 of which are attached to the 3270 protocol converters, and are reached through "CALL 3270." (These numbers may vary slightly due to equipment malfunctions.) As soon as we have achieved a better balance between the number of terminals and the number of ports, we will reopen the Library terminal room. This should be accomplished by the beginning of next semester.

❶ QUESTION: Sometimes when I issue the command "CALL 8040" on the local area network, I get the response "UNABLE TO OPEN SESSION - REMOTE PORT(S) BUSY." This is very frustrating, since I have homework projects due.

❷ ANSWER: Toward the end of the semester, many other students are trying to get their projects done. We have observed that as many as 85 users are on MUSIC at a time. As you can see by comparing this number of users with the number of available ports, all the connections to the 8040 are being used; thus, all the ports are busy. Possible solutions to this problem are 1) learn to use the 3270 protocol converter, and call 3270 instead; 2) try to do your computing at off hours, say before 10:00 a.m. or after 9:00 p.m., during the end-of-semester crunch. Reference cards for the 3270 protocol converter are available in the terminal rooms, or at the Computing Center reception area in the Information Science Building.

❸ QUESTION: I am having trouble getting access to the computer from my terminal at home. Sometimes I don't seem to get connected at all.

❹ ANSWER: Callers who have had problems dialing into the computer system over the telephone should realize that the new modems that receive these calls have an "autobaud" feature. That is, they automatically detect the speed at which the incoming transmission is being made. They do this by examining the "return" signal of the incoming call, and attempting to match its speed. It may require that the caller send the "return" signal 8 to 10 times before the modem can match it; therefore, those dialing into the system should continue to hit their "return" or "enter" keys until the system responds with the "#" local area network prompt. At this point, they may issue the CALL command to connect with the computer they wish to use. There are no direct dial-up connections to the VAX or MUSIC systems available. All dial-up connections are made to the local area network. For 300 baud operation, any of the following phone numbers can be used: 565-3499, 565-5989, 565-3999, 565-4025, 565-4030.

❺ QUESTION: The local area network boxes in some of the terminal areas seem to be broken some of the time. We might be using them, and all of a sudden, they quit working.

❻ ANSWER: One of our recent shipments of local area network modems came equipped with a new software system, which unfortunately was defective. The manufacturer is in the process of fixing the problem, and the boxes should perform more reliably in the future. In the meantime, we have replaced the new, defective software system with the old one, which works.

❼ QUESTION: I have noticed that at times there are only 40 or 50 users on MUSIC, but I can't get a session on the 8040 because all the ports are busy. How can this be?

❽ ANSWER: There are two factors that affect this problem. First, some people who have been using MUSIC have not closed their network sessions with the 8040 when they are finished computing. This keeps the port

busy for 10 minutes longer than necessary, before the local area network automatically closes the session. If users will issue the command LOGOFF after they sign off of MUSIC, this will close the network session, and make the port available for another person. Second, we have had some difficulty with the Memorex 1270 communications controller, which controls all the communication with the 8040. Memorex personnel have been on campus trying to diagnose the problem, and Memorex engineers are trying to fix it. We hope to remedy this situation soon.

- QUESTION: Why don't we have VSAM here at North Texas? Couldn't we have had it on our old NAS-5000 computer?
- ANSWER: VSAM (Virtual Storage Access Method) is an IBM software product available only in conjunction with the MVS operating system. The NAS-5000 did not have the capacity to support the MUSIC and VM operating systems, while at the same time supporting MVS. It was therefore necessary to wait until the installation of the more powerful 8040 computer before introducing MVS and VSAM. The MVS operating system is currently under development, and VSAM will be available some time next semester.
- QUESTION: I am really confused by all these new developments concerning the computers. Now we have the local area network, the VAX computers, and no more card punch machines. It was bad enough just trying to learn COBOL.
- ANSWER: Faculty, students and administration computer users all have different requirements for computing. In order to satisfy the demand for a wide variety of research, instructional, and administrative services, and at the same time to keep up with new developments in computing, the level of complexity involved in using these resources has increased. Unfortunately, not every student, faculty or staff member has been able to keep abreast of these changes. Thus, although some new services have been provided, not everyone has been able to take advantage of them. We hope to combat this situation by increasing the number of short courses we offer, and by providing more consulting services. There will inevitably be a short period in which the flexibility of the system exceeds the capabilities of its users. We will try to make this transition as painless as possible, and we hope that the University community will bear with us.

USING THE COMPUTER FOR RESEARCH: PART XII -
BMDP: BIOMEDICAL AND OTHER COMPUTER PROGRAMS
by Bob Brookshire

In 1961, the Health Sciences Computing Facility at the University of California, Los Angeles, presented a series of computer programs designed to perform statistical analysis for researchers in the health fields. By 1968, these programs had been integrated into a package, with a common, English-like control language. The types of analysis had also expanded so that programs of interest to researchers in other fields were available. The latest edition of the package (1982) contains 42 programs, including programs for econometricians, social scientists, biometricians, and virtually anyone else interested in data analysis.

BMDP Commands

BMDP commands are organized into sentences and paragraphs. Each paragraph must be separated from the others by a slash mark (/), and each sentence must end with a period. Each control word in BMDP commands must be separated by a space from other control words. Otherwise, there is no special format for these commands. You do not have to worry about locating certain commands in certain columns, and it is acceptable for more than one command to be placed on one line in the program. Statements should not be longer than 80 characters to a line, however. The examples in this guide and in the BMDP manual are organized with one command per line so that they are more legible. This is not required.

Those who write their programs in the MUSIC operating system should note that the slash characters that delimit the paragraphs must not be located in the first column or print position on a line. If this is the case, MUSIC will try to interpret the BMDP paragraphs as MUSIC commands (since MUSIC commands also start with the slash mark). You can get around this problem in several ways. One method is to simply put the slash marks in the second column of the line. Another method is to put the slashes at the end of the paragraphs, instead of at the beginning. BMDP doesn't care where the slashes are located, so long as there is a slash in between each paragraph.

Another flexible feature of BMDP is that the verbs "is," "are" and the character "=" can be used interchangeably. In the TITLE sentence, for instance (discussed in the next section), the the statements:

```
TITLE IS 'DATA ANALYSIS'.  
TITLE='DATA ANALYSIS'.  
    and  
TITLE ARE 'DATA ANALYSIS'.
```

are all equivalent to BMDP, even if not correct English usage.

The /PROBLEM Paragraph

The first paragraph in any BMDP program is usually the /PROBLEM paragraph. This paragraph contains the title of the analysis, which is some label of up to 160 characters used as a title on the printout. The title is specified in a TITLE sentence, which is composed of the word TITLE followed by the words IS, ARE or the symbol '=', and then the TITLE enclosed in single quotation marks (apostrophes). The TITLE sentence, like all sentences in BMDP, must end in a period. Do not put the period within the quotation marks--it must be the last character in the sentence. Table 1.1 shows an example of the /PROBLEM paragraph and the TITLE sentence.

Table 1.1: Example /PROBLEM Paragraph

```
/PROBLEM  TITLE IS 'ANALYSIS OF STUDENT TEST DATA'.
```

See the BMDP Manual, (W. J. Dixon, ed., BMDP Statistical Software 1981 (Los Angeles: University of California Press, 1981)) pp. 37-39, for more information about the /PROBLEM paragraph.

The /INPUT Paragraph

In BMDP, the /INPUT paragraph is used to describe the format and location of the data to be analyzed. This is most often accomplished with four sentences: the VARIABLE sentence, the FORMAT sentence, the CASE sentence, and the UNIT sentence.

The VARIABLE Sentence

The VARIABLE sentence (not to be confused with the /VARIABLE paragraph, see below) is used in the /INPUT paragraph to tell BMDP how many variables are in the analysis. Its structure is merely the word VARIABLE (or VARIABLES) followed by IS, ARE or = and the number of variables in the data set. Our example data set has five variables, so the VARIABLE sentence would be: VARIABLES ARE 5.

Don't forget the period at the end of the sentence. The sentences:

```
VARIABLE IS 5.  
and  
VARIABLES = 5.
```

are equivalent.

The FORMAT Sentence

The FORMAT sentence tells BMDP in which columns each of the variables are located. This is done through a format statement in the FORTRAN programming language. For most data analysis purposes, variables can be considered to be one of two types: alphanumeric (A format) or floating-point decimal (F format). Our example data has four variables that are numeric, or F format, and one alphanumeric (i.e. alphabetic) variable, gender.

The general layout of the F format specification is: xFy.z where x is the number of adjacent variables that have the same format, y is the number of columns that the variable occupies, and z is the number of decimal places in the variable. The x portion can be omitted if there is only one variable with a particular format. The student identification number variable in the example data set occupies two columns and has no decimal places. The next adjacent variable, gender, has a different format. Therefore, the format of the student identification variables is F2.0. The test variables are adjacent, and all have the same format. They each occupy two columns and have no decimal places. Their format may be described by 3F2.0.

Format specifications for alphanumeric variables have the general form: xAy, where x is the number of adjacent variables with the same format, and y is the number of columns occupied the variable. Like the F format specification, the x portion can be omitted if only one variable is being described. The gender variable in the example data set is the only alphanumeric variable, and it is located in only one column, so its format would be described as A1.

The entire FORMAT sentence in BMDP consists of:

FORMAT IS '(format specifications)'.

The format specifications must be enclosed in parentheses, and in single quotation marks (apostrophes), and as with all BMDP sentences, the FORMAT sentence must end with a period. For the example data, the sentence: FORMAT IS '(F2.0,A1,3F2.0)'. would be appropriate.

The CASE Sentence

The CASE sentence in the /INPUT paragraph tells BMDP the number of cases in the matrix. Its format is simply CASES ARE n. where n is the number of cases. For the example data, we would use: CASES ARE 20. Don't forget to include the period at the end of the sentence.

The UNIT Statement

The UNIT sentence describes the location of the data on cards, tape or disk. If the data are on cards or in a MUSIC disk file, the UNIT sentence can the end of the BMDP program control statements. If you are using cards, merely place the data cards after the /END statement. If the data are in a MUSIC file, you may:

1. Merge your data file, using the MERGE command in the MUSIC Context Editor, with the BMDP program control statements, locating the data after the /END statment;
2. Use the /INCLUDE "filename" statement following the /END BMDP statement (where "filename" is the name of the MUSIC file which contains the data). Note that the /INCLUDE statment is a MUSIC command, not a BMDP command, and as such should begin in the first column of the record.

See the MUSIC User's Guide, p. 214, for the MERGE Context Editor command, and p. 147 for the /INCLUDE command.

Data on Tape or Disk

If your data are on a magnetic disk or tape in the OS/MVT operating system, the UNIT sentence must be used, in conjunction with a DD statement in the job control language portion of the program, to tell BMDP where to find the data. The UNIT sentence is of the form UNIT IS nn. where nn is any two digit number between 07 and 25. This number refers to the ddname of the DD statement that describes the disk or tape file that contains the data. This DD statement must have a ddname of the form FTnnF001, where nn is the same number as in the UNIT sentence. For example, if the DD statement were:

```
//FT09F001 DD DSN=USER1.D1234.P5678.EXAMPLE,UNIT=SYSDA,  
// VOL=SER=ACAD00,DISP=(OLD,KEEP)
```


the corresponding UNIT sentence would be: UNIT = 9.

Example /INPUT Paragraph

Table 1.2 shows an example of the /INPUT paragraph.

Table 1.2: Example /INPUT Paragraph

```
/INPUT VARIABLES ARE 5.  
  FORMAT IS '(F2.0,A1,3F2.0)'.  
  CASES ARE 20.
```

In this example, we specify that there are five variables, the first occupying two columns in the data with no decimal places, the second being alphanumeric and occupying only one column, and the last three each taking two columns and having no decimal places. There are 20 data cases, and since the UNIT sentence is omitted, we must have the data either on cards or as a MUSIC file. For more information about the /INPUT paragraph, see the BMDP manual, pp. 39-40.

The /VARIABLE Paragraph

The /VARIABLE paragraph has two purposes:

1. To tell BMDP the names of the variables in the data set; and
2. To identify missing value codes for the variables.

Declaring Variable Names

The first function is taken care of with the NAME sentence. The format of this sentence is simply the word NAME (or NAMES) followed by IS, ARE or = and the list of the variables names. Variable names should not be longer than eight characters, and should be listed in the same order as in the FORMAT sentence, which reflects the order of the variables in the data. For the example data, the sentence:

```
NAMES ARE STUDENT, GENDER, TEST1, TEST2, TEST3.
```

would be appropriate.

Missing Values: The MINIMUM and MAXIMUM Sentences

There are several ways to declare missing values for variables in BMDP. One method is to set limits on valid values with the MINIMUM and MAXIMUM sentences. For instance, in the example data, valid student identification codes are from 1 to 20, and any value outside this range is invalid. We can tell BMDP this information with the sentences:

```
MINIMUM (1) IS 1.  
MAXIMUM (1) IS 20.
```

The number in parentheses tells BMDP that this range specification applies to the first variable in the list of names in the NAME sentence. We could declare limits to valid values for the variable TEST1 with the sentences:

```
MINIMUM (3) IS 0.  
MAXIMUM (3) IS 99.
```

Missing Values: The MISSING Sentence

Another method of declaring missing values for variables is with the MISSING sentence. This sentence has the same format as the MAXIMUM and MINIMUM sentences. For example, if we had coded missing student identification numbers as 99, we could use the sentence: MISSING (1) IS 99. to inform BMDP of this.

We can declare maximum, minimum and missing values for more than one variable in a sentence. Simply prefix each value with the number, in parentheses, of the variable to which it refers.

The Treatment of Blank Codes

Sometimes blanks are coded into data fields, instead of numbers or letters. Some researchers use blanks to stand for zeroes, while others use blanks as missing values. BMDP will treat blanks either of these ways if you tell it to do so. In the /VARIABLE paragraph, merely specify either: BLANKS ARE MISSING. or BLANKS ARE ZERO. to inform BMDP how you would like blanks in the data to be treated.

Example /VARIABLE Paragraph

Table 1.3 shows an example /VARIABLE paragraph.

Table 1.3: Example /VARIABLE Paragraph

```
/VARIABLE NAMES ARE STUDENT,GENDER,TEST1,TEST2,TEST3.  
MISSING ARE (1) 99 (2) 9.  
MINIMUM IS (3) 0 (4) 0 (5) 0.  
MAXIMUM IS (3) 99 (4) 99 (5) 99.  
BLANKS ARE ZERO.
```

In this example, we have named all five variables in the data set, and specified missing values for the first two, STUDENT and GENDER. We have also set limits to the valid values of the valid values of the three variables, TEST1, TEST2 and TEST3, through the use of MINIMUM and MAXIMUM sentences. Finally, we have asked BMDP to consider any blank codes in the data to be zeroes.

More information on the /VARIABLE paragraph can be found in the BMDP Manual, pp., 40-42.

The /TRANSFORM Paragraph

The /TRANSFORM paragraph is used to:

1. Recode variables,
2. Create new variables,
3. Select subsets of the data cases for analysis, and other functions.

Recoding Variables

Variables are recoded with sentences of the form IF (logical expression) THEN (assignment). For instance, if a variable STUFF is to be recoded from 0 and 1 to 2 and 4, the sentences:

```
IF (STUFF EQ 0) THEN STUFF = 2.  
and  
IF (STUFF EQ 1) THEN STUFF = 4.
```

would be appropriate.

Variables with alphabet letter codes are recoded similarly. If we wanted to recode the variable GENDER from M and F to 1 and 2, we could use the sentences:

```
IF (GENDER EQ CHAR(M)) THEN GENDER = 1.  
and  
IF (GENDER EQ CHAR(F)) THEN GENDER = 2.
```

The terms CHAR tell BMDP to recode variables that were defined as alphanumeric (A format) in the FORMAT sentence.

Creating New Variables

The creation of new variables is slightly more complicated. Suppose that we want to create a new variable AVERAGE which is the average, for each student, of TEST1, TEST2 and TEST3. The appropriate sentence in the /TRANSFORM paragraph is simply the mathematical statement which defines the new variable: $AVERAGE = (TEST1 + TEST2 + TEST3)/3$. Through this operation, however, we have created a variable that has not been described in the previous /VARIABLE or /INPUT paragraphs. We must adjust the information presented in these places to account for the new variable. This is accomplished through adding the sentence: ADD = 1. to the /VARIABLE paragraph, and adding the name AVERAGE to the lins in the NAME sentence. If this is not done, BMDP will create the new variable AVERAGE according to the instructions in the /TRANSFORM paragraph, but we will be unable to use this variable in our analysis.

More complex mathematical expressions are possible. BMDP has 21 mathematical functions, including exponentiation, Napierian and base 10 logarithms, and the common trigonometric functions, as well as the usual algebraic operations.

Selecting Subsets of Cases

If we wanted to select a subset of cases for analysis, say all the males, all the females, the first ten students, etc., the USE sentence would be employed. This sentence is of the form: USE = logical expression. where the logical expression defines the subset of cases. As a simple example, to select the males, after transforming GENDER from alphabetic to numeric coding, the sentence:

USE = GENDER EQ 1. would be appropriate. More complex logical expressions can also be formed in the USE sentence. For instance, to analyze only the females who scored above 80 on the first test, we would specify: USE = GENDER EQ 2 AND TEST1 GT 80.

Example /TRANSFORM Paragraph

Table 1.4 shows an example /TRANSFORM paragraph.

Table 1.4: Example /TRANSFORM Paragraph

```
/TRANSFORM IF (GENDER EQ CHAR(M)) THEN GENDER = 1.  
            IF (GENDER EQ CHAR(F)) THEN GENDER = 2.  
            AVERAGE = (TEST1 + TEST2 + TEST3)/3.
```

In this example, the variable GENDER is recoded from the alphanumeric values M and F to the numeric values 1 and 2, and a new variable AVERAGE is created as the average, for each case, of the three test scores. Since we have created a new variable, we need to add the name AVERAGE to the NAME sentence in the /VARIABLE paragraph, as well as including the statement ADD IS 1. This informs BMDP that there is one more variable in the analysis than is present in the data, one that we have added in the /TRANSFORM paragraph.

For more information on the /TRANSFORM paragraph, see the BMDP Manual, pp. 49-58.

The /GROUP Paragraph

The /GROUP paragraph is used to specify group names for nominal level variables with numeric codes, and to collapse variables coded at the ordinal, interval or ratio level into categories. These processes are accomplished through the CODES, NAMES and CUTPOINTS sentences.

The CODES and NAMES Sentences

Assuming that we have transformed the GENDER variable in the example data as in the previous section, we can specify the group names using the CODES and NAMES sentences. The CODES sentence is of the form:

CODES(n) ARE # list.

where n is the number of the grouping variable in the NAME list of the /VARIABLE paragraph. The # list is the list of values the variable takes. The GENDER variable is the second variable in the data, and takes

the values 1 and 2 (since we have transformed it in the /TRANSFORM paragraph). Therefore, the CODES sentence would be:

```
CODES(2) ARE 1,2.
```

The NAMES sentence tells BMDP the names associated with the codes of the variable. The format of the NAMES sentence is:

```
NAMES(n) ARE names list.
```

where n is the number of the variable as in the CODES sentence, and the names list is the list of names, in the same order as the codes, associated with the categories. For the variable GENDER, the NAMES sentence would be:

```
NAMES(2) ARE MALE, FEMALE.
```

since GENDER is the second variable in the data set, and has been recoded so that 1 stands for males, and 2 for females.

The CUTPOINTS Sentence

Often it is necessary to recode variables that have been measured at the ordinal, interval or ratio level into categories. BMDP makes this easy with the CUTPOINTS sentence. The format of this statement is: CUTPOINTS(n) ARE n list. where n refers to the number of the variable in the /VARIABLE NAME list, and the number list is the highest values of each of the categories. For example, if we wanted to collapse the variable TEST1 into categories, we could specify: CUTPOINTS(3) = 50, 75. This would create three categories: fifty and below, greater than fifty to 75, and greater than 75. We could then use the NAMES sentence to label the categories: NAMES(3) ARE LOW, MEDIUM, HIGH. Alternatively, we could categorize TEST1 into grade categories using the sentences:

```
CUTPOINTS(3) ARE 64.99, 69.99, 79.99, 89.99.  
NAMES(3) = F, D, C, B, A.
```

Example /GROUP Paragraph

Table 1.4 shows an example /GROUP paragraph.

Table 1.4: Example /GROUP Paragraph

```
/GROUP CODES(2) ARE 1, 2.  
      NAMES(2) ARE MALE, FEMALE.  
      CUTPOINTS (4) = 65, 80.  
      NAMES (4) ARE LOW, MEDIUM, HIGH.
```

In this example, the codes for the GENDER variable are defined and labeled, and three categories are created for the fourth variable in the data set, TEST2.

More information about the /GROUP paragraph can be found in the BMDP Manual, pp. 43-44.

Executing BMDP Programs

BMDP programs are executed individually. Unlike SPSS or SAS, each time you request a different BMDP statistical program, a separate EXEC statement is needed. This means that you cannot request, for example, an analysis of variance and a factor analysis in the same BMDP program. (Different procedures may be requested as different steps in the same job. See the BMDP Manual, p. 47.)

The EXEC statement for BMDP programs has the form:

```
// EXEC BIMED,PROG=BMDPnn
```

where nn is the program name of the procedure you wish to use. For example, program 2V does analysis of variance, so the EXEC statement for this program would be:

```
// EXEC BIMED,PROG=BMDP2V
```

The program for creating crosstabulations is 4F, and its EXEC statement would be:

```
// EXEC BIMED,PROG=BMDP4F
```

BMDP1D: A Data Description Program

Program BMDP1D provides descriptive statistics, including the total frequency, mean, standard deviation, standard error of the mean, coefficient of variation, smallest observed value and its z-score, and the largest observed value and z-score, as well as the number of missing cases for each variable. Optionally, these statistics can be calculated for each level of each grouping variable, and the data can be sorted or printed.

We have one grouping variable in the example data set, the GENDER variable. It might be helpful to ask BMDP1D to provide statistics for each of the groups, as well as for the class as a whole. To do this, we need to add one statement to the /VARIABLE paragraph, telling the program that the GENDER variable is the one we want the statistics broken down by. This statement has the form: GROUPING IS variable list. where the variable list contains the names of the variables to be used to form the groups.

Example Program for BMDP1D

Table 1.5 shows an example of a program using BMDP1D.

Table 1.5: Example Program for BMDP1D

```

/INC OSJE
SYSTEM='OS',TYPE='STUDENT',RETURN
//MU01BMDP JOB (0123-4567,:05,1),'PAM PERRY',CLASS=A
// EXEC BIMED,PROG=BMDP1D
//SYSIN DD *
/PROBLEM TITLE IS 'BMDP1D: DESCRIPTIVE STATISTICS'.
/INPUT VARIABLES ARE 5.
      CASES ARE 20.
      FORMAT IS '(F2.0,A1,3F2.0)'.
/VARIABLE
      NAMES ARE ID,GENDER,TEST1,TEST2,TEST3,AVERAGE.
      ADD IS 1.
      GROUPING IS GENDER.
      USE ARE TEST1,TEST2,TEST3,AVERAGE.
/TRANSFORM IF (GENDER EQ CHAR(M)) THEN GENDER = 1.
      IF (GENDER EQ CHAR(F)) THEN GENDER = 2.
      AVERAGE = (TEST1 + TEST2 + TEST3)/3.
/GROUP CODES (2) ARE 1,2.
      NAMES (2) ARE MALE,FEMALE.
/END
/INC CLASS.DATA

```

The first two statements in this program are not BMDP statements, but are commands for the MUSIC operating system that will direct the job to the OS/MVT operating system, and return the output to OSJR after the job is finished (enter HELP OSJE or HELP OSJR while logged on to MUSIC for more information on these facilities).

The next three statements are job control language statements for the OS/MVT operating system. The first is the JOB statement, which gives the job name (MU01BMDP), the researcher's OS/MVT project number (0123-4567), the estimated time and lines the job will take (5 seconds, one thousand lines), and the researcher's name (Pam Perry). The next statement is the EXEC statement, which asks for the BMDP program 1D. The third statement tells OS/MVT that what follows is the BMDP program, and not more JCL. For more information on job control language, see Part III of the NTSU COMPUTER USER's Guide: "Using OS/MVT" available in the University Store.

The next series of statements are BMDP commands. The first is the /PROBLEM paragraph, which tells BMDP that the title of the analysis is BMDP1D: DESCRIPTIVE STATISTICS. Following this is the /INPUT paragraph, which tells BMDP that there are five variables in the data and 20 cases, and gives the format statement for the variables.

The next paragraph is the /VARIABLE paragraph. This paragraph contains the names of the five variables in the data (ID to TEST3) and the name of an additional variable that will be created in the /TRANSFORM paragraph. The USE statement tells BMDP that we want to get descriptive statistics only on the variables TEST1, TEST2, TEST3 and AVERAGE, since there is no point in getting the means, standard deviations, etc. for the dichotomous grouping variable GENDER, or the identification numbers for the students. The GROUPING sentence is used to provide the statistics

from BMDP1D broken down by the GENDER variable. We also tell BMDP that one of the variables in the NAMES list is being added by transformation, and is not included in the raw data.

The /TRANSFORM paragraph follows. The first two sentences in this paragraph recode the variable GENDER from an alphanumeric (character) variable to numeric values. The third sentence calculates the new variable AVERAGE as the sum of the three test variables divided by three. The /GROUP paragraph labels the recoded values of the GENDER variable as "male" and "female." The /END statement announces that this is all the BMDP program control information for this program.

Note that each BMDP paragraph is indented one space from the left. This is so that the MUSIC operating system will not confuse BMDP commands with MUSIC commands. The last line of this program is not a BMDP command, but is a MUSIC command which appends the data, stored in a file called CLASS.DATA, to the BMDP program. If the program were being run on cards, the data cards would appear here instead of the /INC CLASS.DATA statement. Note, too, that this MUSIC command is not indented, since it is not a BMDP command.

You can see, also, that there is no need for any particular consistency in spacing the BMDP commands. The sentences are indented to improve their readability, but there is no requirement for this.

Example Output from BMDP1D

Table 1.6 shows the output from the program presented in Table 1.5.

Table 1.6: Output from the Example BMDP1D Program

PAGE 1

BMDP1D - SIMPLE DATA DESCRIPTION AND DATA MANAGEMENT
DEPARTMENT OF BIOMATHEMATICS
UNIVERSITY OF CALIFORNIA, LOS ANGELES, CA 90024
(213) 825-5940 TWX UCLA LSA
PROGRAM REVISED JUNE 1981
MANUAL REVISED -- 1981
COPYRIGHT (C) 1981 REGENTS OF UNIVERSITY OF CALIFORNIA
MAY 24, 1982 AT 14:12:09
TO SEE REMARKS AND A SUMMARY OF NEW FEATURES FOR
THIS PROGRAM, STATE NEWS. IN THE PRINT PARAGRAPH.

PROGRAM CONTROL INFORMATION

/PROBLEM TITLE IS 'BMDP1D: DESCRIPTIVE STATISTICS'.
/INPUT VARIABLES ARE 5.
CASES ARE 20.
FORMAT IS '(F2.0,A1,3F2.0)'.
/VARIABLE

NAMES ARE ID,GENDER,TEST1,TEST2,TEST3,AVERAGE.
ADD IS 1.
GROUPING IS GENDER.
USE ARE TEST1,TEST2,TEST3,AVERAGE.

Table 1.6: Output from the Example BMDP1D Program Continued

```

/TRANSFORM IF (GENDER EQ (CHAR(M)) THEN GENDER = 1.
           IF (GENDER EQ (CHAR(F)) THEN GENDER = 2.
           AVERAGE = (TEST1 + TEST2 + TEST3)/3.
/GROUP      CODES (2) ARE 1,2.
           NAMES (2) ARE MALE,FEMALE.
/END
PROBLEM TITLE IS
BMDP1D: DESCRIPTIVE STATISTICS

NUMBER OF VARIABLES TO READ IN. . . . . 5
NUMBER OF VARIABLES ADDED BY TRANSFORMATIONS. . . 1
TOTAL NUMBER OF VARIABLES . . . . . 6
NUMBER OF CASES TO READ IN. . . . . 20
CASE LABELING VARIABLES . . . . .
MISSING VALUES CHECKED BEFORE OR AFTER TRANS. . NEITHER
BLANKS ARE. . . . . MISSING
INPUT UNIT NUMBER . . . . . 5
REWIND INPUT UNIT PRIOR TO READING. . DATA. . . NO
NUMBER OF WORDS OF DYNAMIC STORAGE. . . . . 17918
NUMBER OF CASES DESCRIBED BY INPUT FORMAT . . . 1

***** TRAN      PARAGRAPH IS USED *****

```

The first page of the output shows the page number, the name of the program, and where the program comes from. This example uses the version of BMDP1D that was revised in June, 1981. Next, it shows the date and time the program was run, in this case May 24, 1982 at 2:12 in the afternoon.

The next section of the output states that, by including a /PRINT paragraph with the sentence NEWS., we can receive some remarks about the program, and a summary of the features that were added in the latest revision of the program.

Under the heading PROGRAM CONTROL INFORMATION, BMDP prints out for us the instructions we gave it. These are reproduced exactly as they appear in our program. After printing the program control statements, BMDP interprets them.

The remainder of the first page of the BMDP program output is a description of how the program is going to interpret the instructions it has been given. First, it prints the title. Then it reports that five variables are read in as data, and one added by transformation, so that there are a total of six variables altogether. There are 20 cases in the analysis, and no case labelling variables (see the BMDP Manual, p. 41). Missing values are not checked, since we have not declared any in the program. Blank values in the data are treated as missing, since we did not request that they be treated as zeroes. The input unit number refers to the location of the data, on disk, tape or cards. Unit 5 indicates that the data are included in the BMDP program statements, as shown in /INC CLASS.DATA statement at the end of the example program in table 1.5. The number of words of dynamic storage refers to the amount of computer

space the program has set aside to do the calculations. We have described only one case with the FORMAT sentence. Finally, the program notes that we have used the /TRANSFORM paragraph in the program.

Table 1.7: Output from Example BMDP1D Program Continued

PAGE 2 BMDP1D: DESCRIPTIVE STATISTICS

VARIABLES TO BE USED

3 TEST1 4 TEST2 5 TEST3 6 AVERAGE

INPUT FORMAT IS
(F2.0,A1,3F2.0)

MAXIMUM LENGTH DATA RECORD IS 9 CHARACTERS

I N P U T V A R I A B L E S						
VARIABLE		RECORD	COLUMNS		FIELD	TYPE
INDEX	NAME	NO.	BEGIN	END	WIDTH	
1	ID	1	1	2	2	F
2	GENDER	1	3	3	1	A
3	TEST1	1	4	5	2	F
4	TEST2	1	6	7	2	F
5	TEST3	1	8	9	2	F

PRINT SUMMARY STATISTICS OVER ALL CASES AND
BROKEN DOWN BY INDIVIDUAL CATEGORY ON GENDER

BASED ON INPUT FORMAT SUPPLIED 1 RECORDS READ PER CASE

NUMBER OF CASES READ. 20

VARIABLE	MINIMUM	MAXIMUM	MISSING	CATEGORY	CATEGORY
NO. NAME	LIMIT	LIMIT	CODE	CODE	NAME
2 GENDER				1.00000	MALE
				2.00000	FEMALE

The second page of the program output continues the interpretation of the program control information. At the top of the page, the page number and program title appear. This is followed by the list of variables that are to be used in the analysis, from the USE sentence in the /VARIABLE paragraph of the program. The FORMAT sentence is repeated, and BMDP informs us that 9 characters on each data record will be read. Looking back at the data, we can check to see whether this is correct.

In the next section of the output, BMDP interprets the FORMAT sentence. For each variable in the input data, BMDP tells us what columns it expects to find the data, how many columns wide the variable is, and the variable is, and whether the variable is A type (alphanumeric) or F type (numeric).

The next sentence in the output describes what BMDP thinks we have asked it to do: print summary statistics over all cases and broken down by individual category on GENDER. At this point, BMDP reads the data. It reads one record per case, since this is what the FORMAT sentence case, since this is what the FORMAT sentence tells it to do, and it reads 20 cases. Based on the GROUP paragraph, it reports the category codes and labels for the GENDER variable. If we had specified maximum values, minimum values, missing data codes or cutpoints, it would also report these in this section.

Table 1.8: Output from Example BMDP1D Program Continued*

PAGE 3 BMDPID: DESCRIPTIVE STATISTICS

VARIABLE NO. NAME	GROUPING VARIABLE LEVEL	TOTAL FREQUENCY	MEAN	STANDARD DEVIATION
3 TEST1		20	76.900	19.067
	GENDER MALE	10	74.600	26.784
	FEMALE	10	79.200	6.197
4 TEST2		20	84.600	20.554
	GENDER MALE	10	79.400	28.356
	FEMALE	10	89.800	5.266
5 TEST3		20	78.100	20.708
	GENDER MALE	10	74.800	28.909
	FEMALE	10	81.400	6.736
6 AVERAGE		20	79.867	19.502
	GENDER MALE	10	76.267	27.390
	FEMALE	10	83.467	4.894

VARIABLE NO. NAME	CATEGORY NAME	CATEGORY FREQUENCY	TOTAL FREQUENCY
2 GENDER			20
	MALE		10
	FEMALE		10

NUMBER OF INTEGER WORDS USED IN PRECEDING PROBLEM 572
CPU TIME USED 1.384 SECONDS

*NOTE: Some statistics have been omitted from the example output due to lack of space.

Page 3 of the program output presents the results of the procedure--the descriptive statistics for the variables we specified in the USE sentence (some statistics are omitted due to lack of space). At the top of the page, the page number and the problem title are printed, and then the summary statistics begin. We can see that, for the variable TEST1, the mean of the entire class is 76.9, and the standard deviation is 19.067. The males in the class have a mean on TEST1 of 74.6, and a standard deviation of 26.784. The females have a higher mean, 79.2, and a

much smaller standard deviation, 6.197. Similar statistics are printed for each of the other variables, TEST2, TEST3 and AVERAGE, with the first line of each section being the statistics for the class as a whole, and the next two lines the statistics for each gender grouping.

The last part of the third page of the output gives the number of cases found in each category of the grouping variable, and the amount of storage and processing time consumed by the procedure.

Table 1.9: Output from Example BMDP1D Program Continued

PAGE 4

BMDP1D - SIMPLE DATA DESCRIPTION AND DATA MANAGEMENT
MAY 24, 1982 AT 14:12:19

PROGRAM CONTROL INFORMATION

NO MORE CONTROL LANGUAGE.

PROGRAM TERMINATED

The final page of the output shows the termination of the program. After the page number, the name of the program, the date and time, BMDP reports that it has found no more control information, and the program is terminated. This is the normal ending for BMDP output.

PUBLIC IDS STILL AVAILABLE

Don't forget that MUSIC, the HP 2000, and the VAX Systems A and B all have public ID codes on them that will allow you to "explore" the facilities of each system without having your own personal ID.

- The ID code on MUSIC is LA00. It does not require a password
- The ID code on the HP 2000 is A098 and the password is PGREEN
- The ID code on the VAXs is TEST and the password is TEST

* * * * *
*
* O P E R A T I O N S *
*
* * * * *

Backup Schedule for OS/MVT

OS/MVT disk packs (Academic and Administrative) are backed up daily, Tuesday through Saturday, from 4-6:30 AM, and Sunday from Midnight to 3 AM. A backup of all the operating systems and their contents is done once every two weeks at some low activity period over the weekend.

After-hours Assistance With Terminal and Network Problems

The Computing Center does not have personnel available who are designated to assist users with terminal and/or network problems on weekends or after 5 p.m. on weekdays. If you encounter problems after 5 p.m. on weekdays, or during weekends or holidays that you are unable to resolve yourself with the aid of documentation provided by the Computing Center, then you may call the ISB Input/Output station at 565-2324 and provide the following information to the I/O operator on duty:

- YOUR NAME
- YOUR ID CODE
- TERMINAL TYPE
- ON or OFF-CAMPUS? (if ON CAMPUS, include department, building and room number of terminal)
- DIAL-UP OR DIRECT LINE?
- SHORT DESCRIPTION OF THE PROBLEM

Please provide the above as briefly as possible. I/O Operators have many duties which may require their immediate attention, and they are not free to personally assist you with terminal or network problems.

The I/O Operator will record the information you provide and pass it on to the proper staff member on the next regular working day. Your cooperation is appreciated.

AS/8040 Performance Statistics for October

System Type	Operating Hours Scheduled (OHS)	Maintenance Hours Planned (MHP)	Production Hours Planned (PHP)	Maintenance Hours Unplanned (MHU)	Actual Production Hours (APH)	System Uptime (SU)
VM/SP	744	6.20	737.80	4.82	732.98	99.3%
MUSIC	744	23.12	720.88	13.67	707.21	98.1%
OS/MVT	744	6.86	737.14	19.80	717.34	97.3%
COMPLETE	259	2.57	256.43	11.00	245.43	95.7%
ADABAS	259	2.63	256.37	11.77	244.60	95.4%

Lost Productivity Hours can be contributed to the following key causes*:

CPU, Tape, and Disk Subsystem (NAS)

1. Replace Usage Meter on CPU	1.82 Hours
2. Install 4 Additional Tape Drives	0.75 Hours
3. Perform Special CPU/IOP Diagnostics	2.63 Hours
4. Scheduled Periodic Maintenance	2.58 Hours
TOTAL	7.78 Hours

Terminal Control Systems (MEMOREX)

1. 1270 TCU Malfunctions	3.05 Hours
--------------------------	------------

Electrical Interruptions

1. Power Failure at I/O Station in ISB	2.98 Hours
--	------------

Miscellaneous

1. Undetermined Causes for System Restarts	9.75 Hours
2. Install VM/SP2 Operating System	1.83 Hours
3. Reconfigure Disk Volumes on 7350/7360 Drives	1.73 Hours
4. MVT Job Scheduler Failures	2.28 Hours
5. Rebuild Link Library on MVT	2.08 Hours
6. Resolve Queue Space Limit on VM/SP2	2.17 Hours
7. COM-LETE/ADABAS Program Maintenance	0.38 Hours
TOTAL	20.22 Hours
GRAND TOTAL	34.03 Hours

*NOTE 1: CPU availability will be approximately equal to VM's % Uptime.

*NOTE 2: SU = APH/PHP

*NOTE 3: APH = PHP - MHU

*NOTE 4: PHP = OHS - MHP

*NOTE 5: OHS = PHP + MHP

*NOTE 6: MUSIC's PLANNED MAINTENANCE HOURS includes 16.47 hours of system backup time in October.

*Lost productivity is calculated on the greatest amount of elapsed time that any one of the production systems was unavailable for scheduled operation.


```

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*           *
*       S P S S       *
*           *
* * * * *

```

USERPROC: LISREL

The last issue of BENCHMARKS announced the availability of the user-added procedure called LISREL, a linear modelling program. If you are going to run LISREL, it is necessary to add a PARM field on the // EXEC SPSSX line. It should look like this: // EXEC SPSSX,PARM=240K If you don't do this LISREL will not have enough workspace and you will get an error.

```

* * * * *
*           *
*       B M D P       *
*           *
* * * * *

```

Pairwise Mean Comparisons with BMDP

The following is excerpted with permission from "Pairwise Mean Comparisons in 7D," BMDP Statistical Software Communications 16 (October 1983): 6-7.

After a researcher finds a significant effect in analysis of variance, he or she needs to identify which group means differ significantly from other group means. It is unacceptable to compute the usual two-sample t tests (or confidence intervals) for each possible pair of means, since the probability associated with the t test (or confidence interval) is based on the assumption that only one test is performed. When several means are available for pairwise testing, the probability of finding at least one significant t value (e.g. the difference between the largest and smallest mean) by chance alone increases rapidly with the number of possible pairs. If six independent t tests are computed at $\alpha = .05$, the probability of any one difference being in the critical region is not

$$1 - .95 = .05$$

but

$$1 - (.95)^6 = .265.$$

For ten independent tests, the alpha level for the combined tests is

$$1 - (.95)^{10} = .40$$

Thus, a computed t value in this case with a probability of .05 in standard t tables actually has a probability of .40.

In the 1983 release of BMDP, several procedures have been added to protect against interpreting too many differences as significant when many comparisons are made simultaneously. These have been implemented by Peter Mundel. The Bonferroni, Tukey, Scheffe' and Dunnet procedures have been added to compute pairwise tests and confidence intervals. Two multiple range methods, the Duncan and Student Newman-Keuls tests, have also been added.

Pairwise Tests and Confidence Intervals

The Bonferroni, Tukey and Scheffe' procedures offer different approaches to computing tests and confidence intervals for pairwise mean differences at a more stringent level. For each procedure, the pairwise difference, $u(i) - u(j)$ is said to be significant when the following confidence interval does not contain zero:

$$\begin{aligned} &(\text{mean}(i) - \text{mean}(j)) + L \\ &(\text{mean}(i) - \text{mean}(j)) - L \end{aligned}$$

where L differs for each approach . . .

The Bonferroni, Tukey and Scheffe' procedures provide tests for each possible pair of means. For example, if five pairwise differences are to be tested, the Bonferroni approach uses the 1 percent level for each tests to assure that alpha is held to less than $5 \times 1\% = 5\%$, simultaneously across all five tests. The Dunnet procedure compares the mean of a specified control groups with each of k treatment means. When the number of pairwise comparisons is very large, the Tukey procedure will be most sensitive in detecting differences. When the total number of comparisons is smaller, the Bonferroni may be more sensitive.

BMDP7D displays pairwise mean test results for alpha levels of .01, .05, and .10. (Only .01 and .05 are available for the Dunnet procedure.) Confidence intervals for each procedure can also be obtained. For confidence intervals, $(1 - \alpha)$ is used.

Multiple Range Tests

7D also provides the Duncan and Newman-Keuls multiple range tests. Both of these procedures begin by ordering the k-means and then testing to see if there is a significant difference between the largest and smallest means. If this test is not significant, testing stops and we say that no differences have been found among the means. If, however, this first test is significant, 7D sequentially performs similar tests on smaller and smaller subsets of the means, stopping when the differences are no longer significant. The critical points for measuring a group of k-means differ for each subset size.

The difference between the Newman-Keuls and Duncan procedures lies in the choice of alpha at each subset size. For Newman-Keuls, the alpha level does not change; in the Duncan test, a different alpha is used for each subset size. Miller (1981) prefers the Newman-Keuls procedure to the Duncan, and feels that the Duncan test violates the spirit of simultaneous inference.

Note that in selecting a procedure, it is acceptable to compute the critical points for different procedures and select the one providing the smallest confidence interval (acceptance region) (Miller, 1981, p. 18) be-

cause the choice is independent of the data values. However, you cannot look at the means and then limit the number of comparisons made and maintain appropriate levels of significance.

Reference

Miller, Jr., R. G. (1981) Simultaneous Statistical Inference. 2nd edition, New York, Springer-Verlag.

```
* * * * *
*
*      M U S I C
*
* * * * *
```

TO CALL MUSIC, DIAL: 565-3499;3989;3999;4025;4030.

MUSIC Backup Hours

Following are the scheduled hours for the MUSIC backup. A message will be sent to all users signed-on to MUSIC approximately 10 minutes before the backups are begun, and will be in the form: ** MUSIC SHUT DOWN AT xxxxx AM - SCHEDULED BACKUP ** To find out the backup hours while signed-on to MUSIC, enter HELP HOURS

MUSIC Backup Hours

Tuesday	3 AM (for about 3 hours)	Weekly Backup
Wednesday-Saturday	4 AM (for about 2 hours)	Daily Backup
Saturday	Midnight (for about 2 hours)	Daily Backup

Default Route Location for Printed Output

Effective MONDAY DEC 19, 1983 the default printer destination for the printed output of jobs routed from MUSIC to a high speed printer will be the HP2680 LASER PRINTER, located at the Computing Center/ Dispatch Area, in Information Science Building. The LASER printer replaces the IBM 1403 printer on the AS/8040 for the academic users.

If the RETURN option of the OSJE was specified at the time of the job submission to OS-Batch, the default printer destination can be overridden by specifying the 'To=' parameter of the ROUTE command in OSJR (see HELP OSJR and HELP OSJE). Also, the /*ROUTE PRINT DEST control statement can be used to route the printed output to a specific print destination. Note if /*ROUTE is specified, it should immediately follow the JOB statement of your JCL setup.

For more information on the LASER PRINTER enter HELP OPERATIONS and choose topic 13 or consult the Quick Reference Guide available at the Computing Center reception area.

IBM Scientific Subroutines Now Available on MUSIC

All the scientific subroutines available on OS from the old IBM System/360 Scientific Subroutine Package (SSP) are now available on MUSIC. The source code of these subroutines is written in FORTRAN and can be copied into a program that can then be run on MUSIC or OS, as the case may be, or downloaded to a microcomputer, should you desire to do that. Since the files are public, they may be edited or listed on any USERID.

It should be noted that these are old statistical and mathematical subroutines, and care should be taken that the subroutines are calculating things according to the algorithms that you really want. IBM no longer supports SSP and this represents its last version before support was discontinued. Also, all of these subroutines have not been tested on MUSIC, and may call functions that are not available under MUSIC.

Virtually all subroutines will run without change or with minimal change on the FORTRAN compilers available on common microcomputers, specifically, Microsoft's FORTRAN 80 on Z80 Systems, and MS-FORTRAN on 8088 systems. These subroutines are particularly useful on machines with limited memory, since they are optimized to minimize the use of memory. Because this version was structured for IBM 360 systems, changes that might be required revolve around the use of constants, also RANDU, the random number generator, will not work on a micro. Additionally, if the routines are used with MS-FORTRAN (a subset of FORTRAN 77) it may be necessary to use the COMPILER meta-command \$DO66 in MS-FORTRAN to enable proper exits and entries to and from DO Loops, consistent with FORTRAN 66 conventions.

A reference manual is available in the manual rack in the Science and Technology Library, should you need to consult it. These subroutines are made available for your convenience and use without further support from the Computing Center. Following is a list of the subroutines, as they can be called from MUSIC (Note that a ".SP" has been added to the names to ensure that they remain unique):

ABENDED.SP	ATEI.SP	CADD.SP	CROUT.SP	DAPS.SP
ABSN.SP	ATSE.SP	CANO.SP	CS.SP	DARA.SP
ACFI.SP	ATSG.SP	CCPY.SP	CSP.SP	DA12.SP
ACUMO.SP	ATSM.SP	CCUT.SP	CSPS.SP	DA16.SP
AEVS.SP	AUTO.SP	CDTR.SP	CSRT.SP	DA24.SP
AHI.SP	AUTOR.SP	CEL1.SP	CSUM.SP	DA32.SP
ALI.SP	AVCA.SP	CEL2.SP	CTAB.SP	DBAR.SP
ALLOCATE.SP	AVDA.SP	CHAREQ.SP	CTIE.SP	DCAR.SP
ALPHA2.SP	AXBS.SP	CHECK.SP	DACF.SP	DCE1.SP
ALPHA4.SP	BDTR.SP	CHIS.SP	DAHI.SP	DCE2.SP
APCH.SP	BESJ.SP	CINT.SP	DALI.SP	DCLA.SP
APFS.SP	BESK.SP	CNP.SP	DAP.SP	DCPY.SP
APLL.SP	BESY.SP	CNPS.SP	DAPC.SP	DDBA.SP
APMM.SP	BISE.SP	CONV.SP	DAPF.SP	DDCA.SP
ARAT.SP	BLANKQ.SP	CORR.SP	DAPL.SP	DDGT.SP
ARRA.SP	BOUN.SP	CROS.SP	DAPM.SP	DDT3.SP

DDT5.SP	DQA4.SP	GMSU.SP	NTDUMP.SP	QHSG.SP
DELB.SP	DQA8.SP	GMTR.SP	NTEDIT.SP	QH10.SP
DELG.SP	DQG4.SP	GOPARM.SP	NTRI.SP	QH2.SP
DELS.SP	DQG8.SP	GTPR.SP	NTTIME.SP	QH3.SP
DEL1.SP	DQHE.SP	HARM.SP	ORDE.SP	QH4.SP
DEL2.SP	DQHG.SP	HEP.SP	OUT.SP	QH5.SP
DEP.SP	DQHS.SP	HEPS.SP	OUT4.SP	QH6.SP
DEPS.SP	DQH8.SP	HPCG.SP	PADD.SP	QH7.SP
DETERM.SP	DQL4.SP	HPCL.SP	PCLA.SP	QH8.SP
DET3.SP	DQL8.SP	HSBG.SP	PCLD.SP	QH9.SP
DET5.SP	DQSF.SP	IBMSRT.SP	PDDM.SP	QL10.SP
DE13.SP	DRAR.SP	INUE.SP	PDER.SP	QL2.SP
DE15.SP	DRKG.SP	INVS.SP	PDIV.SP	QL3.SP
DFMC.SP	DRTM.SP	IOUT.SP	PDMPS3.SP	QL4.SP
DFMF.SP	DRTN.SP	IO.SP	PECN.SP	QL5.SP
DFRA.SP	DRTW.SP	I230.SP	PECS.SP	QL6.SP
DGT3.SP	DSE3.SP	I230A.SP	PERM.SP	QL7.SP
DG12.SP	DSG1.SP	JELF.SP	PGCD.SP	QL8.SP
DG16.SP	DSIN.SP	KLMO.SP	PHI.SP	QL9.SP
DG24.SP	DSP.SP	KLM2.SP	PILD.SP	QSF.SP
DG32.SP	DSPS.SP	KPLOT.SP	PINT.SP	QTES.SP
DHAR.SP	DTCN.SP	KRAN.SP	PLRT.SP	QTFE.SP
DHCG.SP	DTCS.SP	LAP.SP	PMPY.SP	QTFG.SP
DHCL.SP	DTEA.SP	LAPS.SP	PNOR.SP	RADD.SP
DHP.SP	DTEU.SP	LBVP.SP	POIN.SP	RAND.SP
DHPS.SP	DTFE.SP	LEP.SP	POLYRT.SP	RANDME.SP
DHSG.SP	DTFG.SP	LEPS.SP	PPLOT.SP	RANGE.SP
DH16.SP	DTHE.SP	LINEQ.SP	PPRC.SP	RANK.SP
DH24.SP	DTLA.SP	LLSQ.SP	PQFB.SP	RCPY.SP
DH32.SP	DTLE.SP	LOAD.SP	PQSD.SP	RCUT.SP
DH48.SP	DTSE.SP	LOC.SP	PRBF.SP	RECP.SP
DH64.SP	DTSG.SP	LOCATE.SP	PRBM.SP	RHAR.SP
DIRNM.SP	DTSM.SP	LSQF.SP	PROB.SP	RINT.SP
DISC.SP	DURBW.SP	MADD.SP	PRQD.SP	RKGS.SP
DJEL.SP	DYNMLOAD.SP	MATA.SP	PSUB.SP	RK1.SP
DLBV.SP	EIGE.SP	MCHB.SP	PVAL.SP	RK2.SP
DLGA.SP	EIGENJ.SP	MCPY.SP	PVSU.SP	RSLM.SP
DL11.SP	ELI1.SP	MEAN.SP	QATR.SP	RSRT.SP
DL12.SP	ELI2.SP	MFGR.SP	QA10.SP	RSUM.SP
DL16.SP	EXPI.SP	MFSD.SP	QA2.SP	RTAB.SP
DL24.SP	EXSM.SP	MFSS.SP	QA3.SP	RTIE.SP
DL32.SP	FCTR.SP	MFUN.SP	QA4.SP	RTMI.SP
DMAT.SP	FMCG.SP	MINV.SP	QA5.SP	RTNI.SP
DMCH.SP	FMFP.SP	MISR.SP	QA6.SP	RTWI.SP
DMGR.SP	FORM.SP	MLSS.SP	QA7.SP	SADD.SP
DMLS.SP	FORVAL.SP	MOME.SP	QA8.SP	SCHEFF.SP
DMPR.SP	FRAT.SP	MPAI.SP	QA9.SP	SCLA.SP
DMRT.SP	FREFMT.SP	MPRC.SP	QG10.SP	SCMA.SP
DMSD.SP	FRIF.SP	MPRD.SP	QG2.SP	SCPF.SP
DMSS.SP	FRIT.SP	MSTR.SP	QG3.SP	SDIV.SP
DMTD.SP	GAUS.SP	MSUB.SP	QG4.SP	SEVS.SP
DNP.SP	GAUSEQ.SP	MTDS.SP	QG5.SP	SE13.SP
DNPS.SP	GDAT.SP	MTRA.SP	QG6.SP	SE15.SP
DPCN.SP	GELB.SP	MULT.SP	QG7.SP	SE35.SP
DPCS.SP	GELG.SP	NDTR.SP	QG8.SP	SG13.SP
DPQF.SP	GELS.SP	NEWMAN.SP	QG9.SP	SICI.SP
DPRB.SP	GMAD.SP	NROO.SP	QHFE.SP	SIGN.SP
DPRQ.SP	GMMM.SP	NTCLOK.SP	QHFG.SP	SIMQ.SP
DQAT.SP	GMPR.SP	NTDATE.SP	QHSE.SP	SINV.SP

SMIR.SP	SSUB.SP	TAB1.SP	THEP.SP	TTEST.SP
SMO.SP	STAEOF.SP	TAB2.SP	TIE.SP	TWOA.SP
SMPY.SP	STPR.SP	TALL.SP	TIMER.SP	UTES.SP
SORT.SP	STPRG.SP	TCNP.SP	TLAP.SP	VARM.SP
SORTEM.SP	SUBM.SP	TCSP.SP	TLEP.SP	VORS.SP
SRAN.SP	SUBS.SP	TEAS.SP	TPRD.SP	WTES.SP
SRAT.SP	SUMF.SP	TETR.SP	TRAC.SP	XCPY.SP
SRMA.SP	SZER.SP	TEUL.SP	TTES.SP	ZEROS.SP

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